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guide to the measurement of the static thrust applied to
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(Reaffirmed 2002)

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Indian Standard

**BRUSH-HOLDERS FOR ELECTRICAL
MACHINES — GUIDE TO THE
MEASUREMENT OF THE STATIC
THURST APPLIED TO BRUSHES**

UDC 621 : 313.047.5 : 620.1

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NATIONAL FOREWORD

This Indian Standard which is identical with IEC Pub 1015(1990), issued by the International Electrotechnical Commission, was adopted by the Bureau of Indian Standards on the recommendation of the Rotating Machinery Sectional Committee (ET 15) and approval of the Electrotechnical Division Council.

The text of IEC Standard has been approved as suitable for publication as Indian Standard without deviations.

Only the English language text given in the International Standard has been retained while adopting it as Indian Standard, and as such the page numbers given here are not the same as in IEC Publication.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

CROSS REFERENCES

In this IEC Standard, for method of fixing, IEC Pub 560(1977) has been referred to. In this Indian Standard, read in its place IS 14196 : 1994 which is adoption of the IEC Standard referred.

Indian Standard

BRUSH-HOLDERS FOR ELECTRICAL MACHINES — GUIDE TO THE MEASUREMENT OF THE STATIC THRUST APPLIED TO BRUSHES

1. Scope

This guide specifies a method of measuring the thrust applied to brushes by brush-holder pressure systems. It applies only to the type of brush-holder in which the brush travels freely within a box.

2. Object

To establish a standard method of measurement of the thrust applied by brush-holder pressure systems.

Note.— There is no direct relationship between the measurement of the thrust applied by this method and the thrust experienced in the machine when in operation or at rest.

3. Principles of measurement

The measurement of the static thrust applied to the brush in a brush-holder consists of measuring the (static) force applied to the brush in its direction of travel and is based upon the application of the following principles:

- 3.1 The thrust applied to the brush when mounted in its holder is measured in the direction of travel.
- 3.2 The measurement of the thrust is carried out using a suitable measuring device. A spring balance is not a suitable device, but can be used to establish only the order of magnitude of the forces.
- 3.3 The measurement to be obtained is the static value of the force applied to a test brush. All the parameters which influence the pressure on the brush, when operating, have only to be considered for the purpose of eventually establishing the value of the static force.
- 3.4 The measurement of the thrust is made whilst the assembly of brush and brush-holder *is stationary* at the chosen reading point and is *free* of all constraints and of the effects of friction by appropriate vibrations. Readings taken when passing from one measuring point to another, such as during an appreciable displacement of the test brush in the box, are excluded.
- 3.5 The masses which influence the values of the readings are to be taken into consideration, for example, the weight of the test brush subtracted from (see Figure 1a) or added to (see Figure 1b) the measured value. The current practice is to ignore the mass of the pressure mechanism.

3.6 If required, the resulting specific pressure p is calculated by the formula:

$$p = \frac{F}{A}$$

where:

F = static force (N)

A = the true cross-sectional area of the brush box (mm²)

Note.— The actual contact surface of the brush on the commutator or slip-ring is not taken into account in the calculation of the specific pressure.

4. Test equipment

To measure the thrust of a brush-holder, a suitable test rig is required. Examples of test rigs are shown in the two schematic diagrams below:

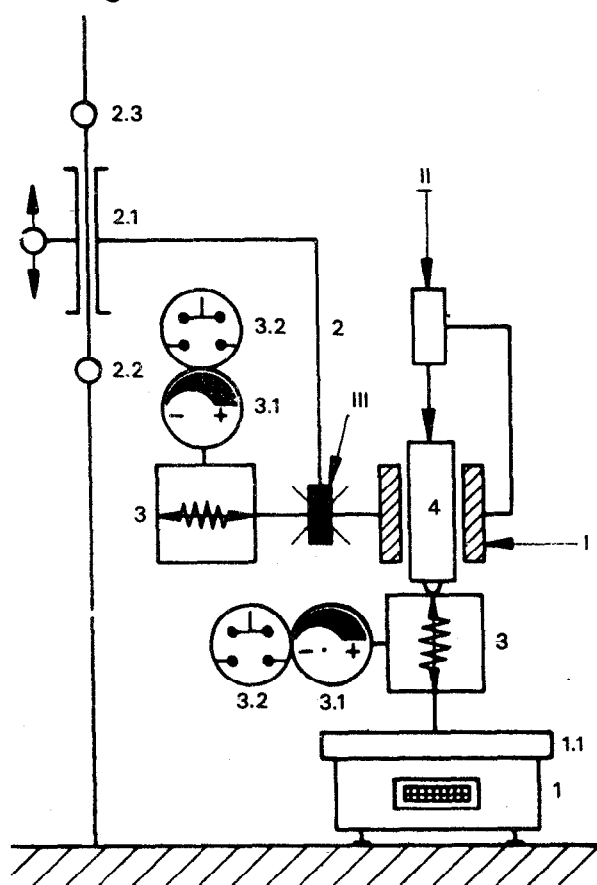


Figure 1a

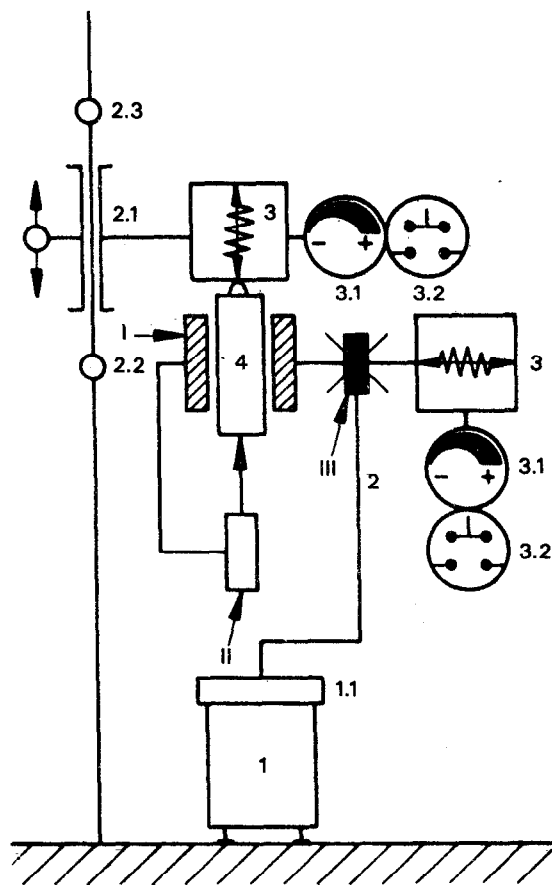


Figure 1b

Figure 1. - Schematic diagrams of test rig.

Key

- I: brush box
- II: pressure system
- III: method of fixing (see also IEC Publication 560, Clause 3)

- 1: measuring device
- 1.1: part of the measuring device to which the load is applied
- 2: support
- 2.1: slide
- 2.2 and 2.3: limiting points for brush-holder or brush travel
- 3: vibration device
- 3.1: variable vibration amplitude setting device
- 3.2: cut-out switch
- 4: test brush

The test rig consists essentially of the following elements:

- 4.1 A measuring device (1) which is a balance or load cell and which has an accuracy of 1%. The part (1.1) to which the load is applied has a displacement not greater than 0.2 mm.
- 4.2 A support (2) for the brush-holder which will position it on the balance in such a way that the axis of the brush box is aligned with the direction of travel of the measuring device.
- 4.3 A slide (2.1) having a displacement parallel to the axis of the brush to allow the brush-holder or the brush to move to the limiting points (2.2 and 2.3) chosen.
- 4.4 Two vibration devices (3) with fixed frequency values selected from the range 50 Hz to 120 Hz with a variable (3.1) minimum amplitude of 0.05 mm. Either one or both of the two vibration devices is used to obtain the optimum stabilization, this being determined by experimentation.
- 4.5 A test brush (4) having a head which conforms to the specification of the brush-holder manufacturer. The base should be provided with a point of support in the axis of the direction of travel in the brush box, examples of which are shown in Figure 2 below.

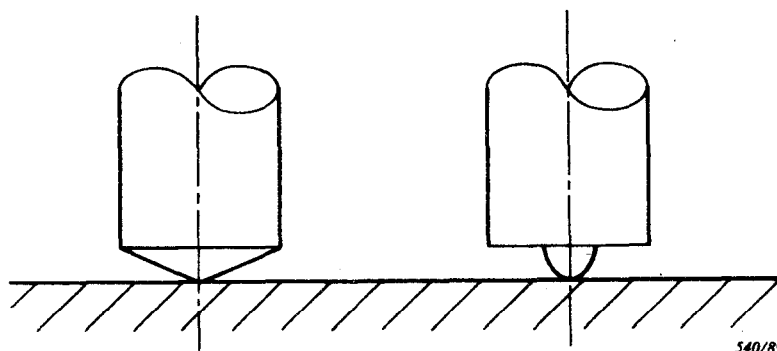


Figure 2. - Examples of points of support for base of test brush.

The dimensions t and a of the test brush are the nominal value t and a of a real brush, subject to the tolerances e6.

To obtain uniform results, in practice, the test brush is made of steel and has a surface finish to $\nabla 6$.

The dimension r of the test brush is not less than the maximum dimension r of the real brush accepted by the brush-holder.

5. Test method

First adjust the position of the stops of the slide in relation to the reading point chosen, then adjust the vibration devices and determine the appropriate amount(s) of vibration.

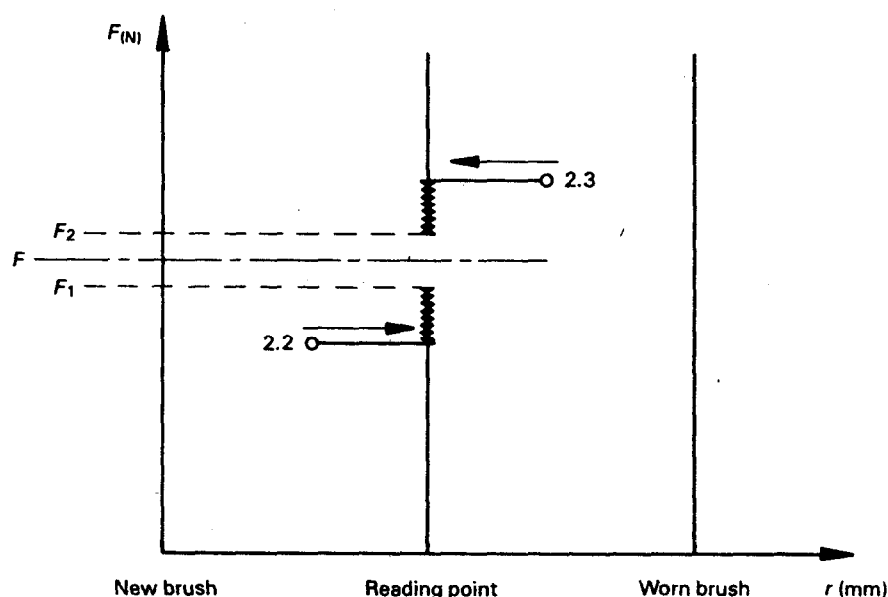
The procedure is as follows:

- 5.1 Fix the brush-holder on the support.
- 5.2 Introduce the test brush into the brush box and then place the spring mechanism in position.
- 5.3 Establish the optimum stabilization for the measuring point chosen by the following experimental method:

Take a reading (F_1) at the measuring point after displacement of the test brush in *one direction* of sliding before immobilisation and vibrations.

Take a reading (F_2) at the measuring point after displacement of the test brush in *the other direction* of sliding before immobilisation and vibrations.

The optimum stabilization is when the two readings F_1 and F_2 are as close together as possible.



541/89

Key: see Figure 1.

Figure 3. - Effect of the vibration on the value of the static force, F .

- 5.4 The value of the static force F is the mean of the values F_1 and F_2 measured under 5.3, i.e.:

$$F = \frac{F_1 + F_2}{2}$$

- 5.5 To obtain readings at any other brush position, repeat the operation described above.

Note.- For the acceptance test of a batch of brush-holders, after the measurement of the thrust of a number of brush-holders out of the batch, the measurement of the thrust of the remainder can be limited to one brush position only.

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Amendments Issued Since Publication

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